

Biomass-related R&D and Non-R&D Activities

**Prepared for:
Biomass R&D Board
for presentation to the
Biomass R&D Technical Advisory Committee**



Jean-Mari Peltier
Agricultural Advisor to the Administrator
USEPA

Environmental Benefits Are a Key Pillar of the Biomass Agricultural Risk Protection Act of 2000



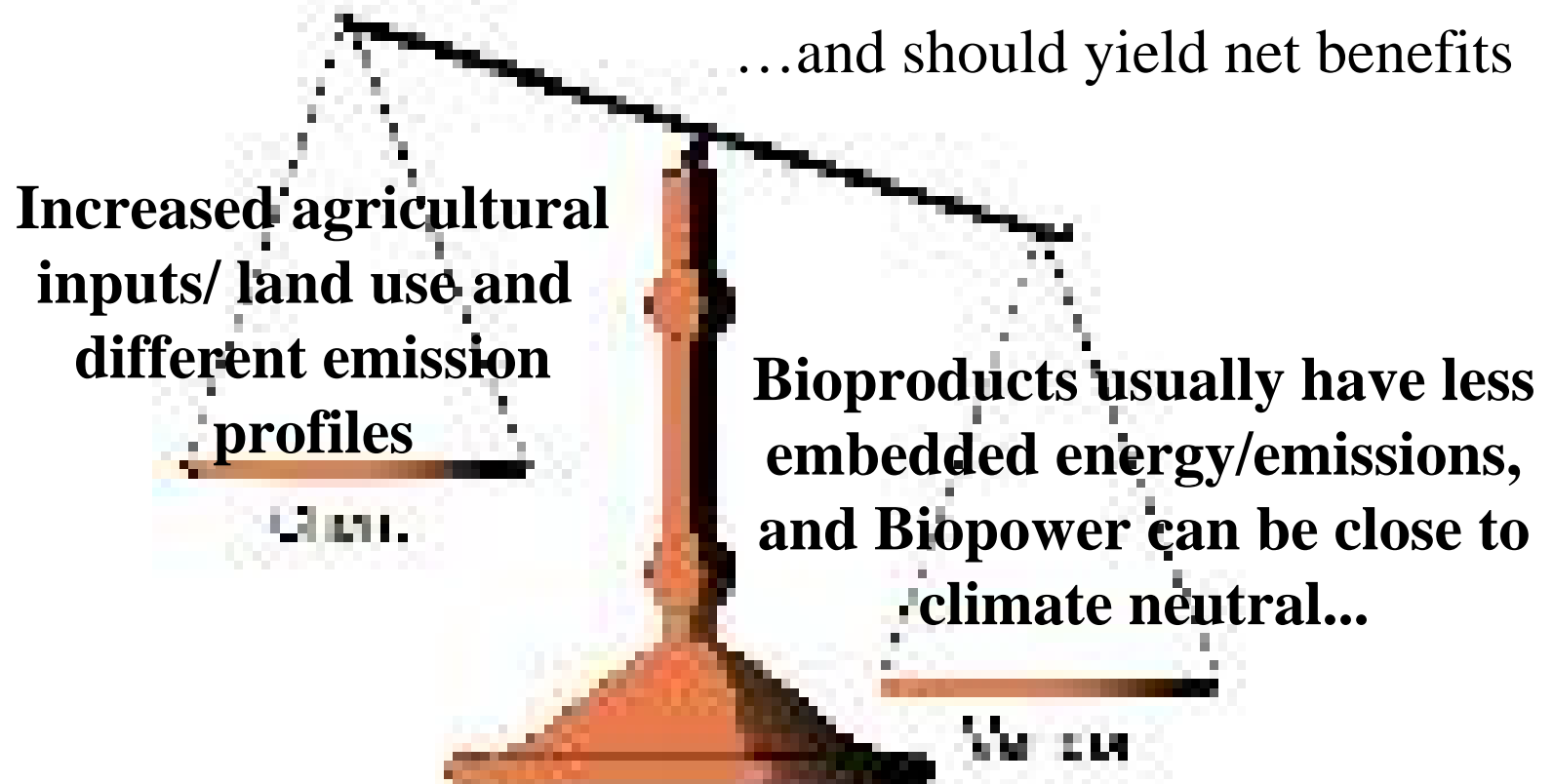
The Roadmap for Biomass Technologies sets ENERGY SECURITY and FARM ECONOMY GOALS...

But, NO ENVIRONMENTAL GOALS

Exhibit 1 Vision Goals

- **Biopower** - Biomass consumption in the industrial sector will increase at an annual rate of 2 percent through 2030, increasing from 2.7 quads in 2001 to 3.2 quads in 2010, 3.9 quads in 2020 and 4.8 quads in 2030. Moreover, biomass use in electric utilities will double every ten years through 2030. Biopower will meet 4 percent of total industrial and electric generator energy demand in 2010 and 5 percent in 2020.
- **Biobased Transportation Fuels** - Transportation fuels from biomass will increase significantly from 0.5 percent of U.S. transportation fuel consumption in 2001 (0.147 quads) to 4 percent of transportation fuel consumption in 2010 (1.3 quads), 10 percent in 2020 (4.0 quads), and 20 percent in 2030.
- **Biobased Products** - Production of chemicals and materials from biobased products will increase substantially from approximately 12.5 billion pounds, or 5 percent of the current production of target U.S. chemical commodities in 2001, to 12 percent in 2010, 18 percent in 2020 and 25 percent in 2030.

on balance, bioproducts and power are environmentally friendly...



But

...but the size and type of benefits, depend on integrating environmental considerations *explicitly* into the process

EPA's INTEREST...

**IDENTIFY AND VALUE ENVIRONMENTAL COSTS / BENEFITS
IN THE PLANNING STAGE, THROUGH DEVELOPMENT,
COMMERCIALIZATION, USE AND DISPOSAL....**

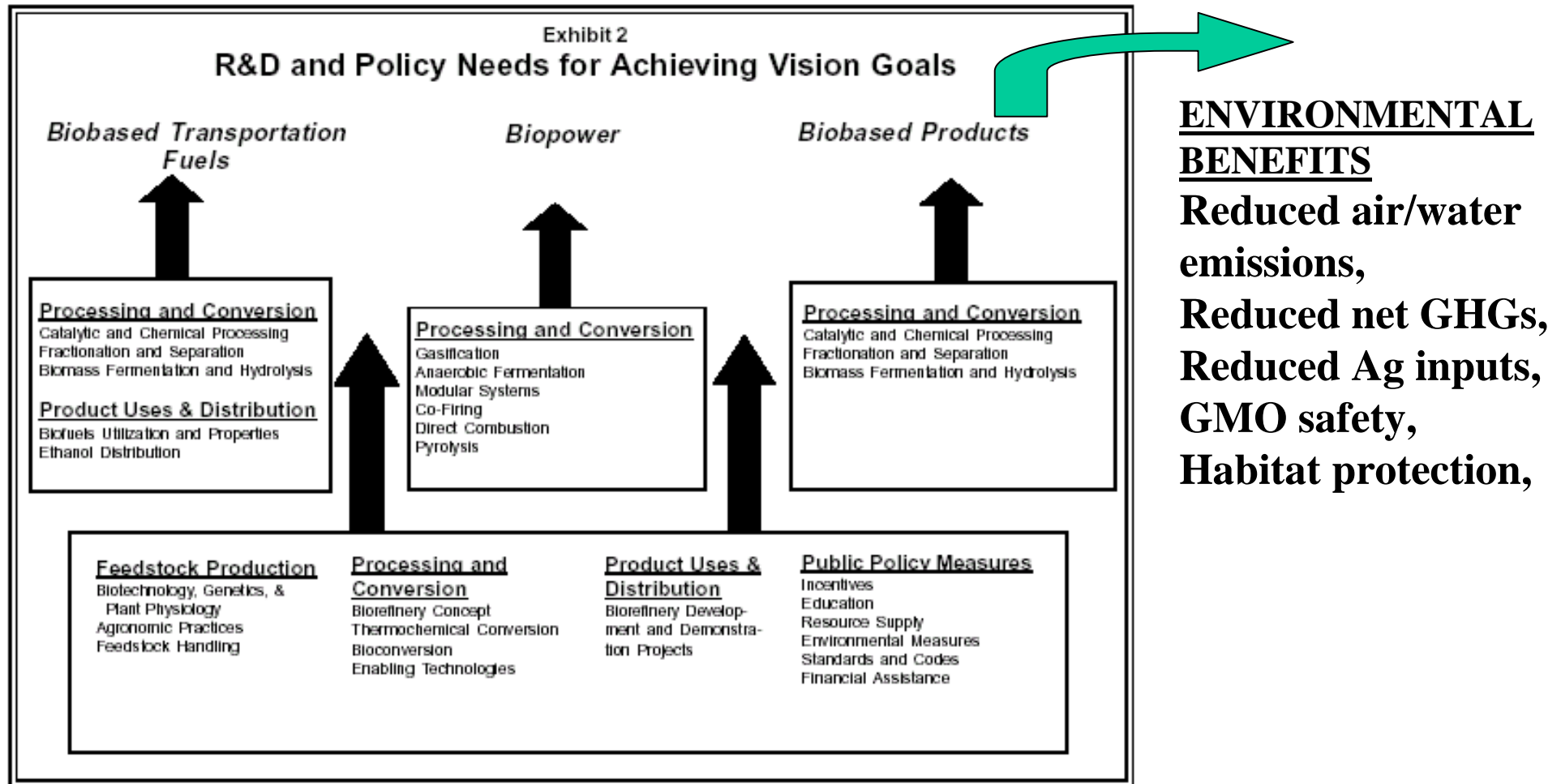
**...TO MAXIMIZE BENEFITS
AND ADDRESS RISKS**



**CARBON SEQUESTERED,
GREEN CHEMISTRY, AIR,
WATER QUALITY IMPROVED,
REDUCED WASTE PRODUCTS,
SUSTAINABILITY. ETC.**

**INCREASED LAND USE,
& WATER USE, INCREASED
PESTICIDE USE, MONOCULTURE
HABITAT, DIVERSITY
LOSSES, GMO RISKS, ETC.**

...Without explicit goals, environmental risks/benefits could take a back seat to other priorities:



EPA's Role:

EPA regulations affect biomass research, production, processing, use, and disposal...

EPA has authority and programs to increase biomass use and can grow biomass markets...

EPA can value biomass environmental benefits, and assess environmental costs of biomass projects...

EPA can test, certify and verify biomass initiatives



EPA regulations affect biomass research, production, processing, use and disposal:

AIR QUALITY

WATER QUALITY

DEFINITION OF WASTE

WASTE USE/MANAGEMENT/DISPOSAL

RUN-OFF

NEW CHEMICALS

CHEMICALS W/ PESTICIDAL PROPERTIES

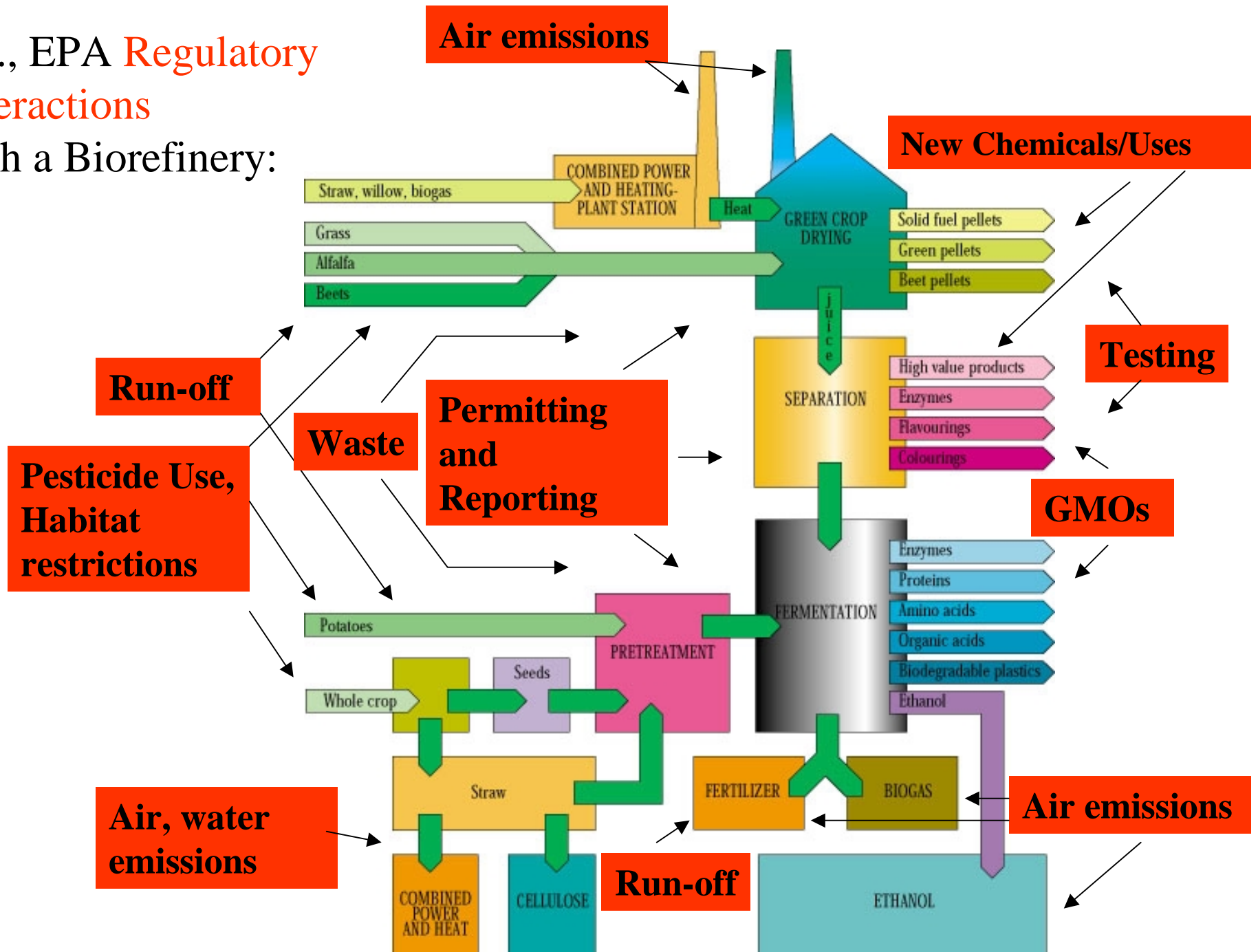
ORGANISMS (e.g., GMOs)W/ PESTICIDAL PROPERTIES

ENVIRONMENTAL LABELS

MONITORING AND VERIFICATION

HABITAT USE

e.g., EPA **Regulatory Interactions**
with a Biorefinery:





EPA's Ag Compliance Assistance Center can address farmers questions about requirements

- The Center works with USDA & other agencies to provide the Ag community with a definitive source for federal environmental compliance information
- Information includes:
 - Pesticides, Animal Waste management, Emergency Planning & response, Groundwater / surface water, Tanks / containment, Solid/hazardous waste

EPA's National Center for Environmental Innovation (NCEI)...
a newly formed office encourage innovative approaches to
environmental protection, through:

Performance Track Program

Industry Sector Performance Program

Consideration of Regulatory Flexibility Proposals

EPA has authority and programs to increase biomass use and can grow biomass markets:

Use:

AgSTAR ...livestock waste to energy

Greenscapes ...land application of bio-based waste

LMOP (Landfill Methane Outreach Program)... promotes use of LM for energy

Green Chemistry ...help design safer biobased product substitutes

Markets:

EPP (Environmentally Preferable Purchasing Program)... can encourage Federal procurement of bio-based products

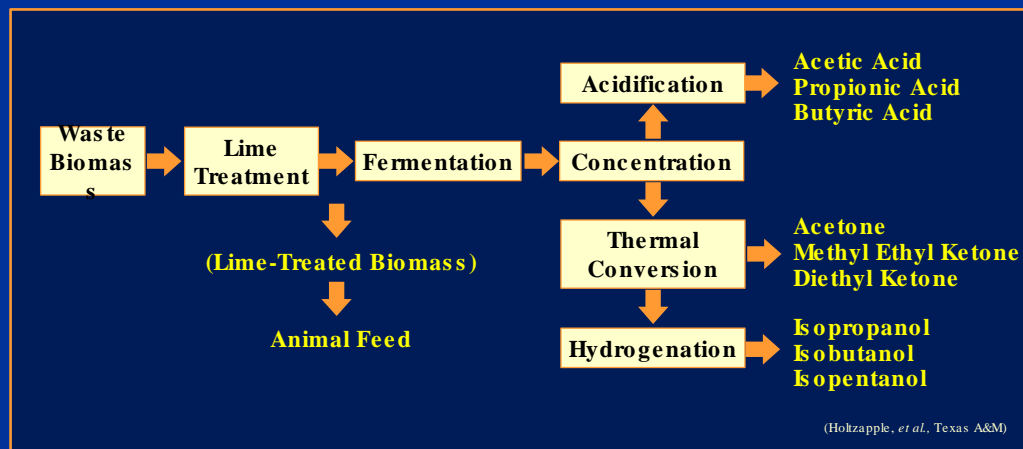
CPG (Comprehensive Procurement Guidelines)... encourages required federal procurement of recycled (including biobased) materials

EPA's Green Chemistry Program has developed feedstocks and products with big environmental benefits from biomass...e.g.,



Green Feedstocks

Use of Biomass in the Synthesis of Animal Feed, Chemicals, and Fuels



Green Products

Green Composites from Renewable Sources

(Richard Wool, University of Delaware)

- Uses soy oil to manufacture high performance plastics, adhesives, and composites
- Variable properties (biodegradability)
- Inexpensive, strong, chemical and temperature resistant, recyclable
- Potential applications include agricultural equipment and machinery, automotive panels, marine equipment, rail infrastructure, and construction applications

The Federal EPP Program...can help grow markets:

**Environmentally
preferable purchasing**
incorporates key
environmental factors
with traditional ***availability***,
price and ***performance***
considerations in
purchasing decisions.



...empower Federal consumers to make smart purchasing decisions that reflect environmental considerations

Provides guidance to Agencies to practice EPP, through pilot projects and tools

Pilot projects highlight bio-based alternatives

Tools incorporate bio-based considerations

Works with NIST to develop a life cycle-based decision support tool

Works with USDA on its bio-based listing process

EPA's Comprehensive Procurement Guidelines Program **aka Federal Government's "Buy-Recycled" Program**

Uses Federal buying power to create markets for recycled products.
Creates end-use markets for recovered materials in new products.

Has designated 54 items in eight product categories :

Paper and Paper, Vehicular Products, Construction, Transportation, Park and Recreation, Landscaping, Nonpaper Office, and Miscellaneous Products

Agency's strategy for maximizing purchases designated items:

- preference program

- promotion program

- estimates and certifications of recycled content

- monitoring and reviewing program effectiveness

- compliance inspections and assistance

EPA can value biomass environmental benefits and assess environmental costs of biomass projects...

NCEE (National Center for Environmental Economics)... provides tools, information and guidelines for assessment of environmental costs and benefits

NCEA (National Center for Environmental Assessment)...provides tools, information and guidelines for lifecycle and other assessments

EPA can test, certify and verify biomass initiatives...

ETV (Environmental Technology Verification) ... Can test commercial-ready environmental technologies to aid buyers, sellers and permittees in making decisions regarding environmental technologies.

EPAs assessments can value environmental benefits:

Enhanced Biomass Use and Environmental Benefits:
Co-firing Biomass can reduce emissions

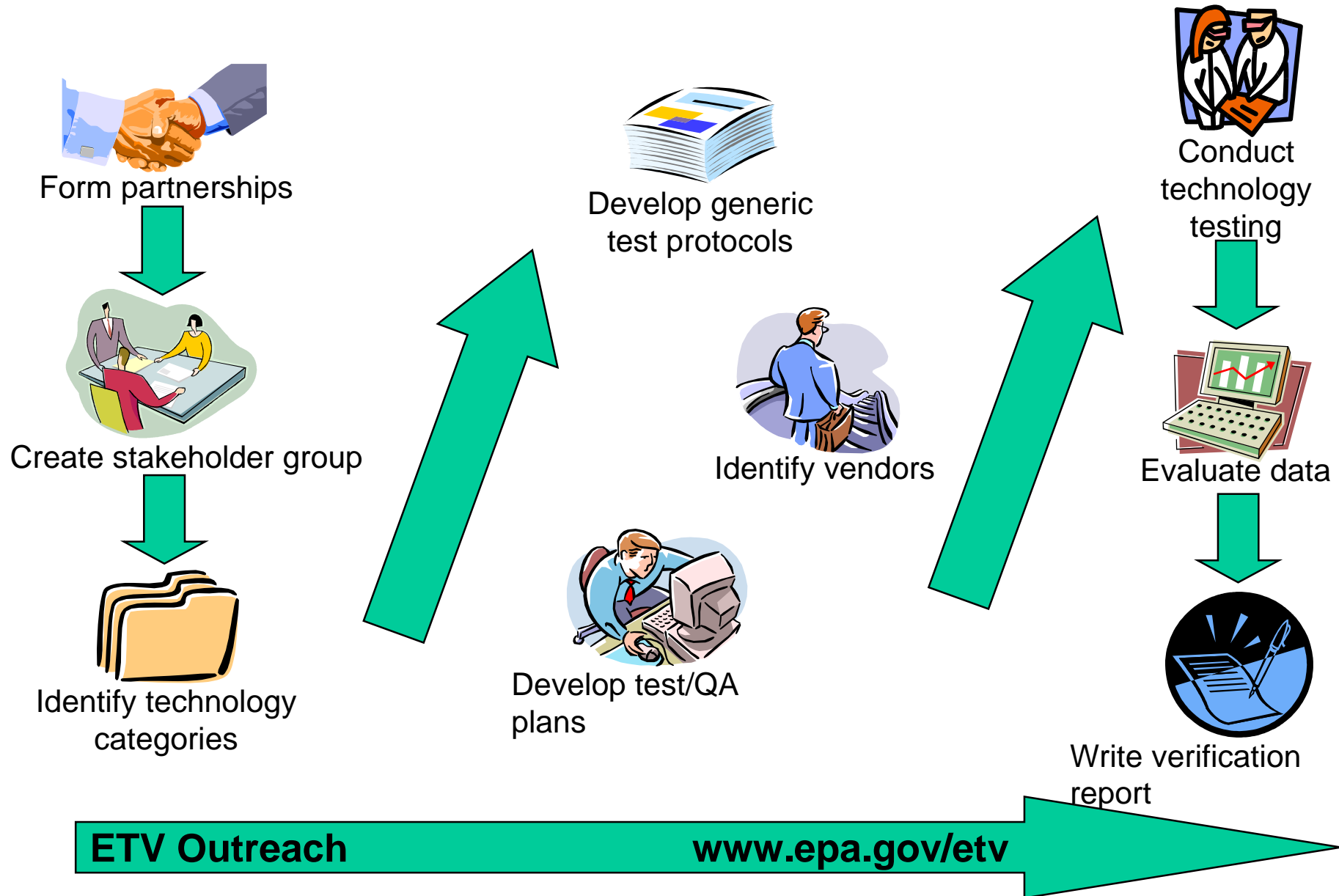
Change in Emissions

	3 fold Increase Over AEO 1999 Scenario			3 fold Increase Over Base Case Scenario		
	2005	2010	2020	2005	2010	2020
SO ₂ (MTons)	-22.5	9.7	0.1	163.4	-70.1	0.4
NO _x (MTons)	-5.3	-20.3	-19.8	-47.0	-153.2	-150.8
CO ₂ (Million Tonnes)	-2.0	-4.8	-5.8	-11.2	-37.8	-40.7
Mercury (Tons)	-0.1	0.0	-0.1	-0.1	-0.7	-0.4

Example of what output from electric utilities model looks like...
increase refers to 3X increase in cofired biomass

New biomass technology or products can be submitted to the...

ETV Verification Process



EPA supports research in biotechnology and bioprocessing

Some examples from the STAR grants program: Technology for Sustainable Environment (in partnership with NSF)



John Dorgan, Colorado School of Mines, has helped develop a commercial process to convert corn to polylactic acid (PLA), a useful plastic used in many materials, including packaging.



John Frost of Michigan State University is exploring alternative routes, using microbial biocatalysis, to synthesize resorcinol, a chemical used in the manufacture of useful materials such as adhesives and UV blockers.

This process utilizes a renewable, environmentally benign feedstock, glucose, in place of benzene.

Nancy Ho of Purdue University has metabolically engineered yeast to ferment both glucose and xylose—the two major sugars present in cellulosic biomass-- to ethanol, an environmentally friendly fuel.

EPA STRONGLY RECOMMENDS INTEGRATING “ENVIRONMENT” INTO THE PROCESS...

Make Environmental Benefits/Costs a Driver in
R&D and in Strategic Planning

Require LifeCycle Assessments of Major Initiatives

Make Environmental Benefits a Criteria in Funding
Decisions

Monitor to Verify Environmental Systems Operate as
Planned

Only way to ensure that the Potential Benefits of Bio-energy and Bio-products are realized

Reducing GHG emissions and sequestering carbon

- Liquid and solid bio-fuels can offset fossil fuels
- Bio-products can store carbon long-term in usable materials.
- Biomass crops sequester carbon and enhance soil carbon.

Development and commercialization of new products with improved environmental performance

- Bio-derived ethanol as an alternative to MTBE
- Starch-based, compostable plastics and resins
- Fuel and other products from animal wastes

and,

Opportunities for improved solid waste management

- Divert municipal solid waste from landfills -- e.g., waste to ethanol
- Provide backstop markets for low valued recyclables
- New bio-based processing produces less waste

Opportunities for improved land use practices

- Riparian buffers and low lands could improve water quality and floodplain management
- Select management systems to maintain/promote wildlife habitat and biodiversity
- Utilize perennial grasses and trees to control erosion and reduce sedimentation

and Potential Risks from Bio-energy
and Bio-products are minimal

- Air/Water emission profile changes for biofuels/bioprocessing
- Water quality and quantity impacts from increased fertilizer/pesticide use and irrigation;
- Adverse ecological impacts from habitat loss, and monoculture increase;
- GMO Risks;
- Impacts on recycled materials markets; and especially,
- Law of unintended consequences

Some Program-based Biomass Energy and Bio-Products Efforts...

- **OPEI**: Assessed advanced technologies for storing carbon in biomass products. Analyzed environmental effects/benefits of co-firing.
- **OSW**: Assessed benefits of bio-products, technical opportunities to separate carbon based materials from MSW streams, assessments of composting costs.
- **OAR/OAP**: Implemented landfill methane outreach program and AgStar program under the Climate Change Technology Initiative.
- **OAR/OTAQ**: Conducts research, outreach and education on biofuels as part of their broader program to assess and promote alternative fuels.
- **OPPTS**: Evaluates environmental impacts of bioproduct lifecycles. Promotes federal procurement of bioproducts that are environmentally preferable, and funds small business research into innovative bioproducts
- **ORD**: Through support from DOE, conducts research on small scale biomass gasification systems. Conducts in-house research on methanol technologies. Conducts verifications of swine and dairy CAFOs anaerobic digester gas as fuel for onsite power generation with partnering from New York and Colorado states.
- .

Potential EPA Role:

- Strategic Assessment and Planning, Identify Opportunities, Pitfalls;
- Promote federal procurement of bioenergy and bioproducts which are environmentally preferable;
- Technical assistance, regulatory flexibility, when appropriate
- Expand Markets through labeling, incentives;
- Use economic and environmental accounting tools to quantify and value changes in:
 - air, and water quality, net GHG flux, waste quantities, habitat, and other environmental parameters;
- Coordinate with DOE and USDA in assessing the environmental implications of pilots and demonstrations.